ONR Programs in Modeling and Simulation for Training

Office of Naval Research

ONR Programs

- Affordable Human Behavior Modeling (6.1, 6.2)
- Virtual At-Sea Training (6.3+)
- Maritime Synthetic Range (Congressional)

Modeling and Simulation for Training: Affordable Human Behavior Modeling

Program Officer, ONR 342

Affordable Human Behavior Modeling

M&S for Training

Objective

Techniques and design principles that enhance the affordability and usability of realistic human behavior/cognitive models for application as Intelligent computerized Forces (IFORs) in simulation for training, acquisitions and analysis

Technical Approach

Enhance affordability and usability of HBM technologies, e.g.,

- Automate KA/E (now 50-70% of cost)
- Create a high level model traceability to to lower time/expertise to build/validate
- Develop modular multi-agent architectu & other tools to facilitate component re-

Challenge

- M&S community acknowledges training value of realistic, full function human mode
- Current modeling techniques have potent to support realistic training

HOWEVER

- These models have a very limited military market because they are unaffordable

Success Means

- Military simulation community for first time
  can afford realistic full-function IFORS
- Requirement for large numbers of costly SAF
  controllers is eliminated

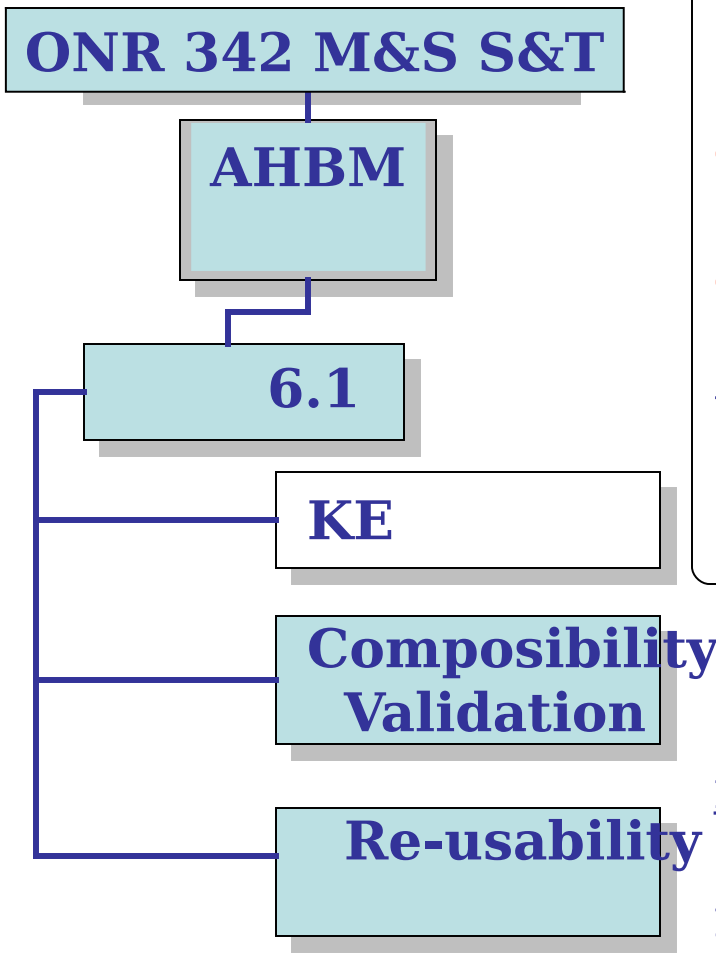
M&S for Training

AHBM Program Overview: The Economic Case

- Simulation for training is personnel-intensive
  (SAF controllers, role players)
  - Very expensive: $5.0-$10M per large exercise in personnel cost
  - Inflexible—preclude frequent or on-demand training
- One solution: fully automated intelligent synthetic force
  - Cut simulation personnel costs by 75% (NAVAIR-Orlando)
  - Eliminate high personnel logistics tail, raise training flexibility,
- Problem with this solution: IFORS prohibitively expensi
  - $500K-1.0M/each; exercises can require 10-20 tactical entity m
- Real solution: IFORs that are both full function and affo

Affordable Human Behavior Modeling 6.1 Products

M&S for Training



KE (Knowledge Engineering)
(**Determine specific competencies to model, avoiding high-cost knowledge engineers**)

- First technique to **automatically** translate
  SME performance on easy-to-build HSI task
  mock-up into a valid cognitive model
  ACT-R
  (Prototype shows order-of-magnitude reduction
  in time to produce an accurate model)

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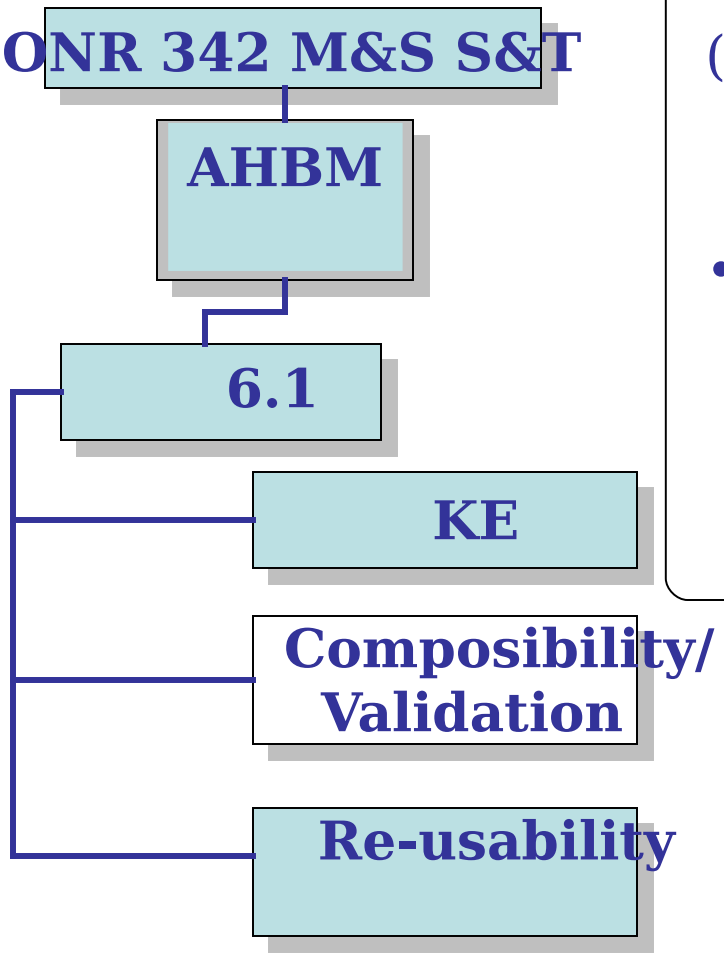
Affordable Human Behavior Modeling 6.1 Products



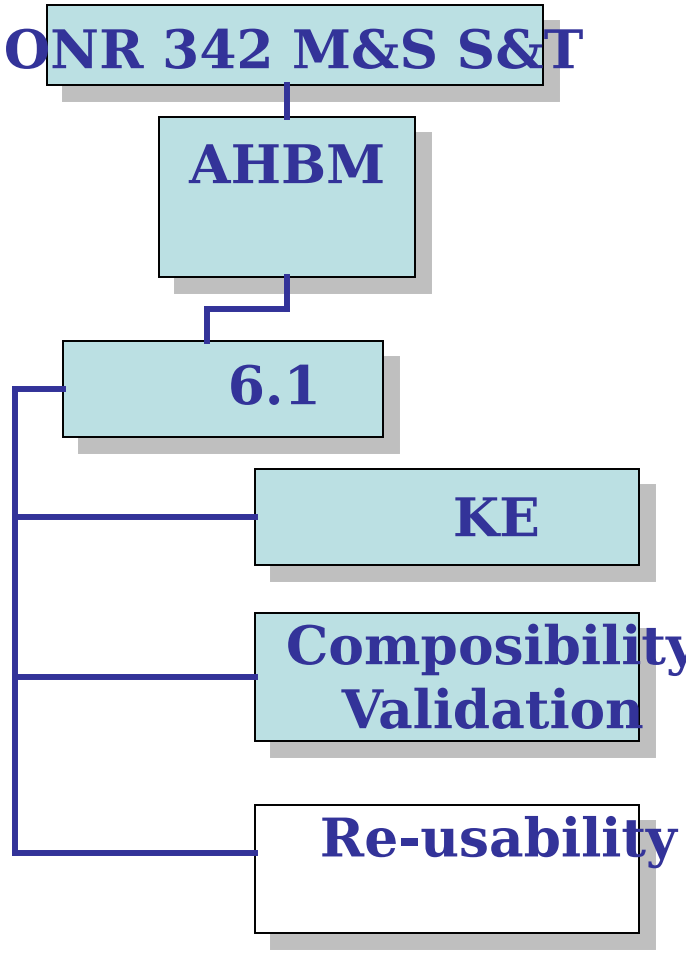
Composability, validatio

(Create valid executable models at lo
by reducing S/W engineering suppor
simplifying coding tasks & code veri

- Self-explanation capability for HBM (w did that) to more quickly de-bug, corre rules, complete rule sets, trace error s (5X speed-up in model composition, validation shown by Mod-1 version)

Affordable Human Behavior Modeling 6.1 Products

M&S for Training



Re-usability

(**Enable efficient exploitation of prior modeling solutions for new applications to minimize "start-from-scratch" costs**)

- A case-based reasoning engine for efficient interrogation of large databases of tactical acts (e.g., OneSAF) or behavior models (elements) to retrieve most relevant previously developed components to compose new applications.

Likely transition to OneSAF

Affordable Human Behavior Modeling 6.2 products

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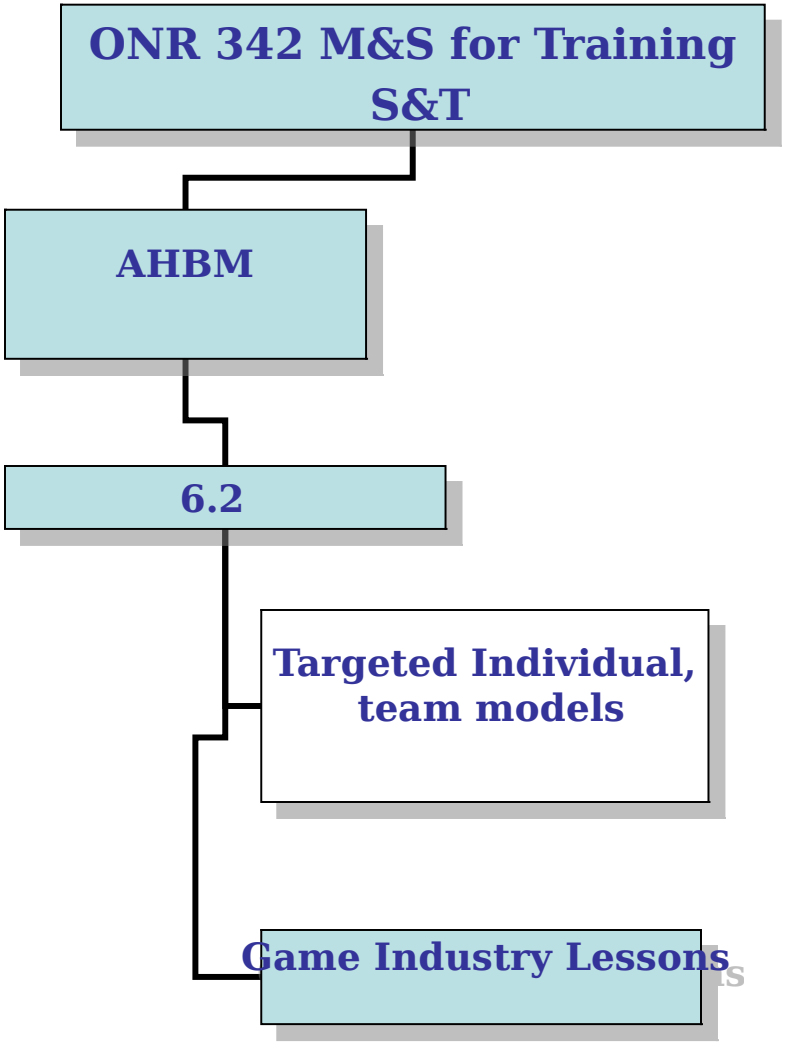


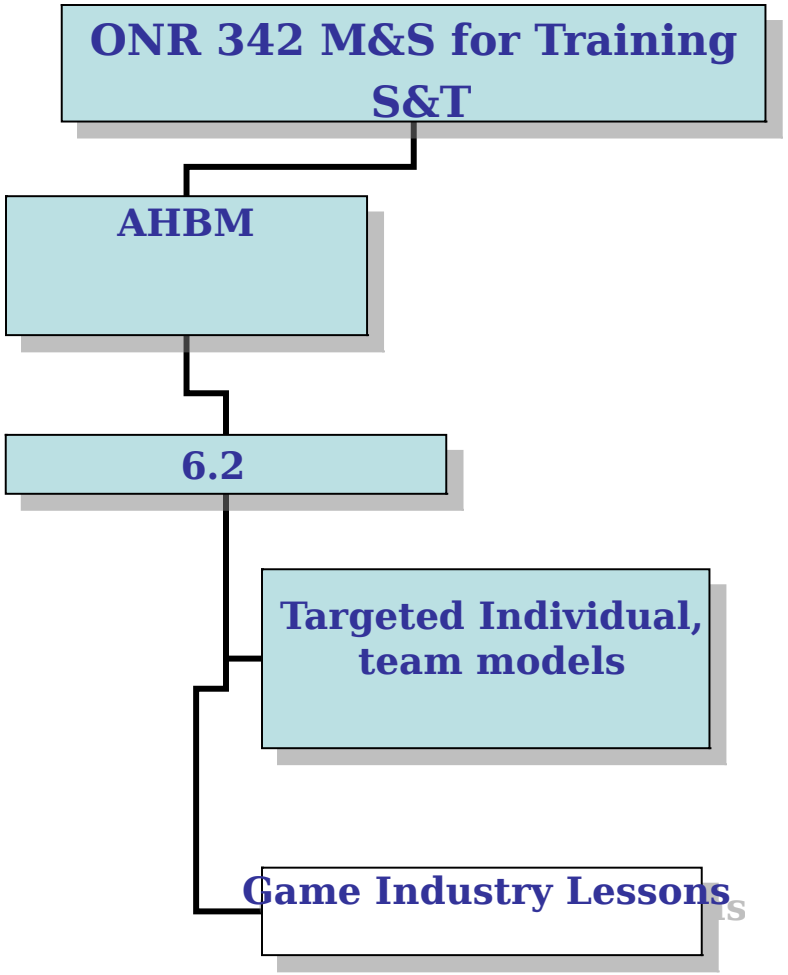
Application-Targeted Individual, Team Models

(**Improve perceptual/cognitive competence of models; enhance individual, team behavior realism/training effectiveness**)

- Intelligent OPFORs (subs) and BLUFOR elements (selected BG ASW nodes—SH-60, P3-C, BLUSubs) to enable flexible use of **ASW AirVAST** training system (**DARPA** funding match)

Affordable Human Behavior Modeling 6.2 products

M&S for Training



Game Industry Lessons

(**Commercial games a billion $ industry. Can its products be exploited to meet military HBM/simulation requirements?**)

- Survey of industry AI products to assess potential for military application
- Evaluation of utility of open-source commercial games as a low cost development platform for military HBMs

(Report available: contact me)

Virtual At-Sea Training (VAST)

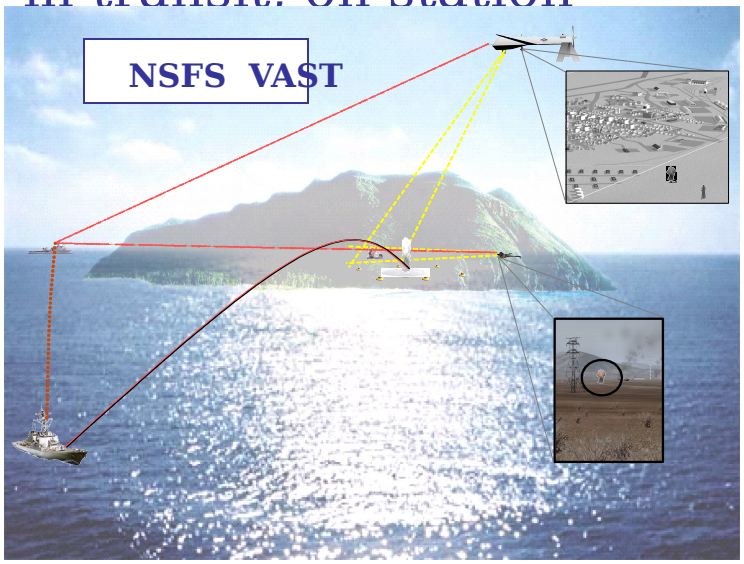
(Partners: ONR, N61M, FFC N7, JFCOM J7 (JNTC), PEO IWS 1E, PMA 205, PMA 248, CMD, FLTASWCOM, NAVAIR-Orlando, DMSO)

ONR VAST Management Team

Virtual At Sea Training (VAST): A Family of Deployable Combat Training Technologies

M&S for Training

- Project **VAST** was a response to loss of Vieques range
- **VAST** is a related set of training systems exploiting mixes of live, virtual & constructive technologies to provide combat units the use of live or constructive fire against simulated targets in synthetic terrain for realistic, deployable training any time or place--pierside, in transit, on station



VAST Systems

- **Naval surface fire support (NSFS)**
- **Air ASW (MRT3)***
- **USMC indirect fire weapons trainer**
- **Tiered portable USW training range***
- **DC VAST for shipboard damage control training**

***Will exploit AHBM technology**

VAST Has High Visibility in the Navy, DoD and Beyond

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Publications featuring stories about VAST over the past 2 years

1. Navy Newsstand (11/17/2002)
2. Stars and Stripes (11/26/2002)
3. Navy Newsstand (12/06/2002)
4. Military training Technology (Vol 7, Issue 8, 2003)
5. Jane's defense Weekly (1/22/2003)
6. Business Climate Magazine (1/01/2003)
7. Popular Science (2/2003)
8. Training and Simulation Journal (3/2003)
9. Rhumb Lines (5/07/2003)
10. Norfolk Virginian Pilot (8/24, 2003)
11. Human Factors Engineering Bulletin (12/2003)
12. Armed Forces Journal (11/2003)
13. Norfolk Virginian Pilot (10/02/2003)
14. Defense Science Board Report for Training (Jul 2003). VAST was one of only 3 training technologies described in depth as representing the future of DoD combat training.
15. Norfolk Virginian Pilot (10/10/2003)
16. Rhumb Lines (10/ 21/2003)
17. National Defense (11/2003)
18. Training & Simulation Journal (10-11/2003)
19. Military Training Technology (Vol 9, Issue 3, 2004)

Operational Navy Leadership Embraces VAST

M&S for Training

"ASW AirVAST is an extremely high value training tool that will help us meet our need to do integrated training, as well as support our T&R matrix: it's exactly what we need and the vision is right on track."

HSLWINGPAC Commodore
CMD AirVAST Demonstration, 23 OCT 2003

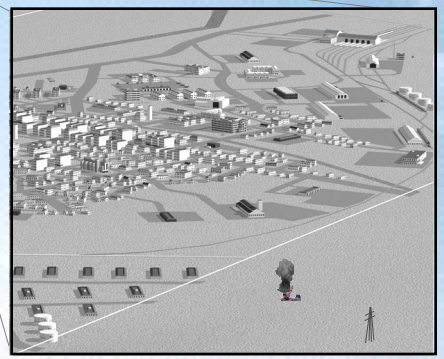
"VAST is important (to me and the Navy) and will play a big part in the New Fleet Response Program Envisioned by the CNO"
COMCARGRU Four, 10 OCT 2003

"The Navy intends to buy enough of the deployable (VAST) systems to provide one to each battle group"
CFFC
Training & Simulation Journal, March 2003

"I view VAST as a very important training program for the Navy."
CNO
USNI Convention, Va Beach, 08 OCT 2003

VAST Naval Surface Fire Support

Training in Ship-to-Shore Fires



- 3 component systems delivered to LANTFLT Q-2 03
- Used to qualify/train 25+ ships (DDs, CGs) to date
- Used for pre-deployment training in C2X for CCG4
- CFFC wants full VAST systems for all DDGs
- Funding partners: ONR, N61M, PMA-

Coordinated training for entire NSFS team

ASW AirVAST (MRT3)

Tactical Team Trainers
For all Battle Group ASW nodes

- Laptop trainers for all participants in BG Air ASW
- Not stick and rudder trainer
- Trains cognitive/comms/team skills for coordinated end-to-end (search to attack-re-attack) Air ASW
- Participating elements: SH-60 (B & F), P-3C, DDG, ASW module (CVN), IUSS asset, AX node, Threat subs, Blue subs
- Customers: COMNAVAIRFOR & FLTASWCOM
- Transition resource sponsor: PMA-205

In-AirVAST: In-flight AC Interoperating with In-Port BG & Support Simulators via CSB

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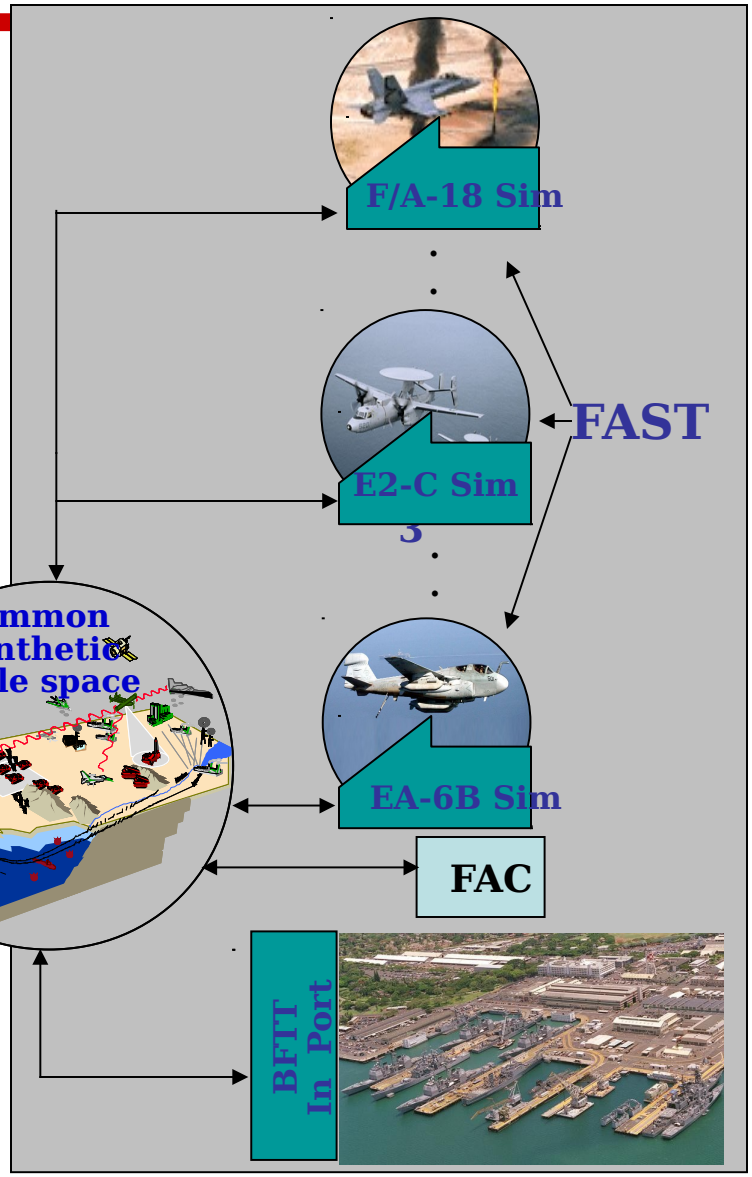
Technologies:
I: BFTT/CSB Linkage
II: Air/Gnd Link

Voice/Tactical Comms
Simulation Data

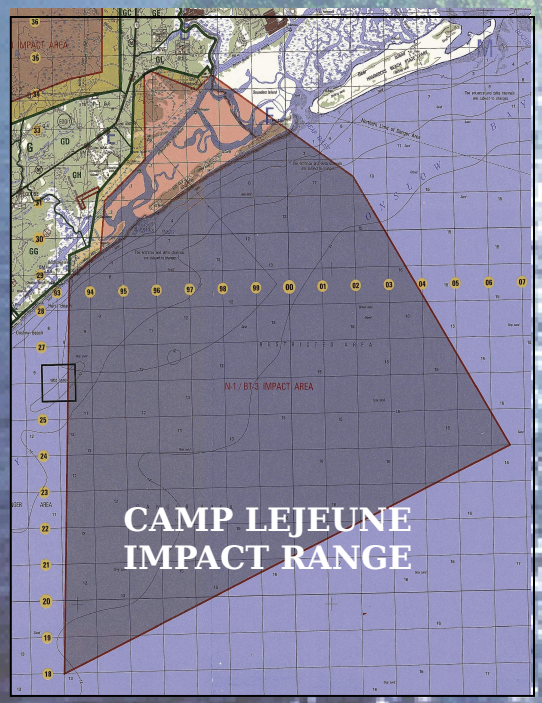


Notional CONOPS

- AC linked to/from BG, SAF and warfighter-in-the-loop trainers via **PMA-248**-developed on-wing pod RF link to Networked Common Synthetic Battlespace (CSB)
- On-wing AC pod simulates AC Weapons through 1553 interface
- In live ordnance mode, weapon impact

- **Builds on, augments two large PORs: TCTS (wing mounted-P5 pod) and FAST (new networked simulator system for Naval aviation)**
- **VAST provides advanced threat environment and networking of in-flight AC, CSB, simulators, BFTT**

VAST Concept For USMC Long-Range Artillery Team Training: An ONR TechSolution



- CONOPS similar to NSFS VAST
- Funds provided for system development by ONR TechSolutions
- Customers: USMC TECOM, Camp Lejeune Training Command
- Prototype demo scheduled for SEP 2004

HIMARS Weapon System

Maritime Synthetic Range

Status Overview

Office of Naval Research

M&S for Training

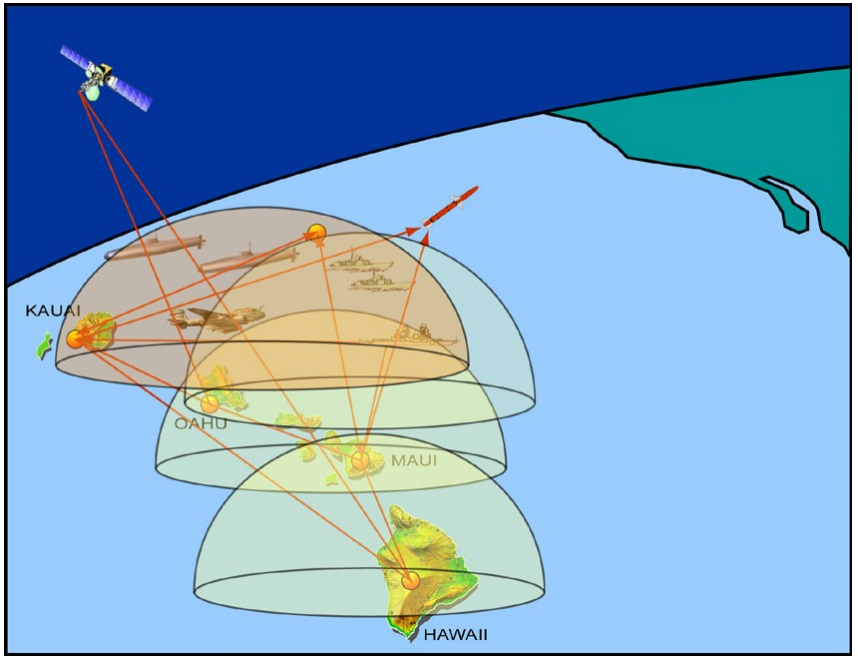
Management Effort since FEB 2004 Focused on Aligning MSR with Fleet/JFC/PMRF Needs

- Early FEB the ONR MSR Program Manager, charged with
  - Raising MSR visibility, value, customer base in the Fleet
  - Bringing MSR effort in line with Fleet/Joint Forces needs and requirements
  - Supporting use of MSR investment to build Hawaii's High Tech Sector
- Early MAR new management team met in HI with PACOM, PACFLT (N7), and PMRF leadership to discuss MSR opportunities, priorities
- These meetings, and discussions with FFC (N7), JFCOM and SAIC project management, gave rise to a draft MSR CONOPS
  - Responds to Fleet/Joint Forces needs/requirements
  - Supports and builds on virtually all prior MSR investment
  - Mandates some modification in future course of program
- Early AUG, ONR team and JFCOM, FFC representatives met with PMRF CO, PACOM, PACFLT, MSR on-site management team
  - Confirmed Fleet and Joint Forces support for MSR vision
  - Verified MSR consistent with FFC & JFCOM training requirements

High Level MSR Objectives

M&S for Training

- Integrate live and synthetic systems to enhance training and testing capabilities at PMRF
- Support range interoperability
- Create common synthetic threat environments for distributed training and testing
- Increase complexity and geographic extensibility of PMRF training capability
- Increase frequency and reduce cost of testing and training events



New MSR CONOPS Aligns PMRF with Major New Initiatives in Fleet & Joint Forces Training

- **MSR**: a synthetic combat training range that is interoperable with the Navy Continuous Training Environment (**NCTE**) and supports Pacific Theater training requirements within the Joint National Training Capability (**JNTC**)

- Capabilities developed in MSR
  - Consistent with CFFC N7 **T&E/Training Strategic Plan** & **TASK FORCE SIM** findings and recommendations
  - Enable Joint Force training within synthetic environment distributed across Joint service training ranges in accord with **JNTC Joint Management Office** vision for Live-Virtual-Constructive training integration
  - Provide Navy live range node to support RDT&E activities for JNTC Advanced training Technology Laboratory (**JATTL**)

Planned MSR Capabilities Address Specific Fleet & JFC Needs

M&S for Training

- Enable training participation by units pier-side, underway or deployed within the Mid-Pac Area of Operations and Pacific theater
- Provide intelligent synthetic BLUFOR and OPFOR to support training of individual platforms in BG and JTF level exercises
- Permit scenario generation based on real-world terrain and bathymetry databases to support realistic training/mission planning
- Establish a common threat environment that stimulates onboard sensors real-time across participating platforms (**JSAF, BFTT**)
- Tailor network architectures (**TENA, HLA**) to incorporate MSR into JNTC/NCTE & support real-time exercise feedback
- Extend coordinated ASW training provided by PMRF fixed range to forward-deployed assets through portable underwater range to be developed by NUWC
via VAST funding